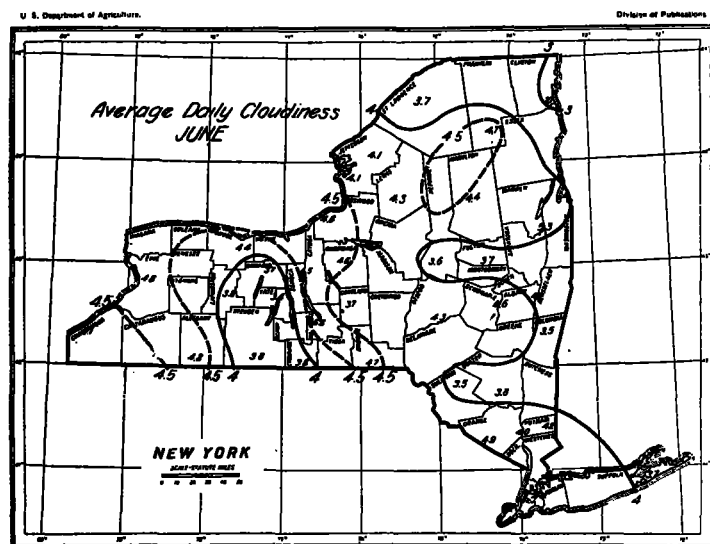


west-central section can be explained by a glance at the contour map where it can be shown to coincide fairly well with a tongue of relatively low land running down from Lake Ontario and bounded on either side by land 500 to 1,000 feet higher. This is the region of the "Finger Lakes." The eastern half of the State, while on the whole much less cloudy than the western, shows maxima and minima clearly influenced by the



land elevation. For example, the clearest section is the west shore of Lake Champlain under the lee of the Adirondacks with an approach to it in Ulster County under the lee of the Catskills and the high plateau to the west; while the cloudiest spot in the eastern half of the State seems to be Schoharie County, at the end of a narrow trough of low land extending northwest to Lake Ontario through which moisture-laden winds may pass to be condensed there on the northern slopes of the Cats-

kills. The relatively high cloudiness around New York City is probably local and due to city smoke and sea fogs or those arising from the harbor, which are at the maximum at about this time.

Turning to the June map we find much greater uniformity throughout the State, owing to the facts that the northwest winds from the lakes are more rare and that the land surface is warmer, but the minima over Lake Champlain and west-central New York still persist, although in not so pronounced a form. The influence of the mountains is still shown, and a new minimum has appeared in eastern Long Island. This last is probably due to causes mentioned in the author's earlier paper on the climate of this region published in *Climatological Data for New York in 1917*, viz, that this region is on the edge of the cloud belt resulting from St. Lawrence Valley storms, which are the prevalent summer type, and to the relative infrequency of thunderstorms, due to the proximity of the ocean and the trend of the coast which tends to keep the temperature low and uniform.

These maps show quite clearly the relation of wind, large water surfaces, and land elevation to cloudiness. Further study would probably show a correspondence with rainfall, and especially snowfall, as it is well known that the southeast shore of Lake Ontario is one of the snowiest regions of the United States.

#### AMATEURS RECEIVE FORECASTS BY WIRELESS TELEPHONE.

A letter from Mr. Eric R. Miller, of the Weather Bureau station at Madison, Wis., states that the Physics Department of the University of Wisconsin has for several months been sending out at 10 a. m. the weather forecast for Wisconsin. The wave length is 1,000 meters. Plans are under way to supply this information by wireless telephone. The apparatus is powerful enough for the messages to be audible to amateurs throughout the southern half of Wisconsin.

#### MODIFYING FACTORS IN EFFECTIVE TEMPERATURE; OR, A PRINCIPLE OF MODIFIED THERMAL INFLUENCE ON ORGANISMS.<sup>1</sup>

By ANDREW D. HOPKINS, Forest Entomologist in Charge of Forest Insect Investigations.

[Bureau of Entomology, United States Department of Agriculture.]

In connection with the writer's studies of the application of the bioclimatic law to the forecasting of the dates of events in the seasonal activities of insects, the optimum time to apply remedies for their control, other periodical farm practices, the latitude and altitude limits of distribution of organisms, etc., it has been found that the departures of the recorded variable from the computed constant dates of events are, in general, progressively earlier with higher latitude and altitude, or vice versa. It has also been found that certain regions of the United States are characterized by later departures, while the reverse is true of other regions.

According to the laws of temperature control of the seasonal activity of organisms, it has been assumed that a temperature above 45° to 50° F. is required to stimulate activity or that a given accumulation or sum of heat above the effective is required for the development of seasonal events.

It would seem, therefore, that an explanation of the regional departures might be found in the prevailing temperature, but an effort to apply this principle led

to confusion rather than to an explanation of the causes of such variations.

It is natural to assume that acceleration of activity, represented by an early departure from the constant, would be associated with a relatively higher temperature, but when the mean temperatures of the regions of uniformly early or late departures were studied it was found that, as related to the major regions, progressively higher mean temperature with lower latitude and altitude was associated with progressively later departures, and vice versa.

It is plain, therefore, that, while temperature is an important factor of control, there are other factors that modify its effective influence which are related to latitude, longitude, and altitude. It seems (as indicated by the writer in SUPPLEMENT 9 of the MONTHLY WEATHER REVIEW, 1918) that the amount and character of daylight, sunshine, etc., exert an important modifying effect on life activities and that this effect is not reflected in the recorded temperature. It would appear, therefore, that it is in the variation of the effective influence of light, and evidently other elements of climate, with varia-

<sup>1</sup> Presented before American Meteorological Society, Washington, D. C., Apr. 22, 1920.

tion in geographical position, that we are to find an explanation of the modified effects of temperature.

The results of recent investigations on this theory seem to warrant the recognition of a principle of modified thermal influence which is intimately related to the principles on which the bioclimatic law is founded.

In an effort to determine a gradient or unit constant by means of which the intensity of this modifying influence, from whatever cause, could be measured and computed, it was found that a general average rate of  $0.25^{\circ}$  F., or its equivalent of one day in time, for each  $1^{\circ}$  isophane and 400 feet of altitude could be utilized for correcting the recorded thermal means or the computed date constants for any given geographical position so that there would be a reasonably close agreement between the cause as represented by the modified temperature and the effect as represented by the recorded date of an event.

In comparing the departures of the recorded from the computed dates of events in the different regions by the modifying method it was found that, in general, the regional departures, as determined by the usual method, were accounted for. It must not be expected, however, that anything but the general regional influences can be interpreted by this method because it can not provide for the topographic and other influences which are reflected in the local departures.

There is need of further investigations of the problems relating to this proposed principle and it is hoped that they will receive due consideration by meteorologists as related to the laws and principles of temperature, light, etc., and by biologists and physicists as related to the practical application of the principle in their investigations of the responses of organisms to the influences represented by temperature and other elements and that there will be cooperation in the investigations of the relations of causes and effects.

It appears, however, that the present state of information on the coordinate relation of thermal unit constants to the other unit constants of the law will justify a revision of the first table of coordinates<sup>2</sup> as related to (a) latitude, longitude, and altitude, and (b) the isophanes and altitude, as follows:

Tables of geographic coordinates and unit constants of the bioclimatic law.

(a) FOR LATITUDE, LONGITUDE, AND ALTITUDE.

Coordinates.	Unit constants.				
	Geographic.			Modifying.	
	(a) Geographic.	(b) Time.	(c) Thermal mean.	(d) Thermal.	(e) Time.
1. Latitude.....	$1^{\circ}$ .....	4 days.....	$^{\circ}$ F. 1	$^{\circ}$ F. 0.25	1 day.
2. Longitude.....	$5^{\circ}$ .....	do.....	1	.25	Do.
3. Altitude.....	400 feet.....	do.....	1	.25	Do.

(b) FOR ISOPHANES AND ALTITUDE.

Coordinates.	Unit constants.				
	Geographic.			Modifying.	
	(a) Geographic.	(b) Time.	(c) Thermal mean.	(d) Thermal.	(e) Time.
1+2. Isophane.....	$1^{\circ}$ .....	4 days.....	$^{\circ}$ F. 1	$^{\circ}$ F. 0.25	1 day.
3. Altitude.....	400 feet.....	do.....	1	.25	Do.

<sup>2</sup> Journal of the Washington Academy of Sciences, Jan. 19, 1920, p. 38.

## CLIMATIC CONDITIONS IN A GREENHOUSE AS MEASURED BY PLANT GROWTH.<sup>1</sup>

Climatic conditions are usually stated in terms of temperature, rainfall, percentage of sunshine, relative humidity, etc. A few attempts have been made to measure such conditions in terms of plant growth. In one of these experiments the climatic conditions of a greenhouse were expressed as rates of certain definite plant processes. The experiment was carried out (1916-1917) in one of the greenhouses of the Laboratory of Plant Physiology of the Johns Hopkins University at Baltimore, Md. Buckwheat seedlings of approximately the same size and from the same stock of seed were grown for a series of 4-week exposure periods over a total time period of 13 months. Such culture plants were considered the instruments for measuring the climatic conditions as these affected the plant processes. Values representing the process of dry-weight production, leaf-area increase and transpirational water loss increased during the spring and decreased during the autumn with maxima in summer and minima in winter. The rates of stem elongation, however, showed remarkably low values for a period about the summer solstice. Approximate indices of efficiency of these climatic conditions in this particular greenhouse to favor these plant processes may be briefly stated in relative numbers for each calendar month as follows:

Month.	Stem height.	Dry weight.	Leaf area.	Transpiration.
January.....	0.64	0.13	0.20	0.11
February.....	.70	.27	.35	.24
March.....	1.03	.61	.63	.63
April.....	1.30	.90	.84	.87
May.....	1.34	1.00	.95	.96
June.....	1.00	1.00	1.00	1.00
July.....	1.30	.94	.91	1.00
August.....	1.46	.81	.79	.95
September.....	1.40	.61	.63	.69
October.....	1.14	.39	.49	.40
November.....	.92	.22	.37	.24
December.....	.76	.15	.27	.15

The approximate annual ranges (ratio of maximum to minimum) were: Stem height, 2; dry weight, 8; leaf area, 5; transpiration, 9.—*Earl S. Johnston, Laboratory of Plant Physiology, Maryland Agricultural Experiment Station.*

## THE DISTRIBUTION OF MAXIMUM FLOODS—DISCUSSION.

We have received a letter from Mr. H. R. Leach, of Saginaw, Mich., commenting on the paper by Prof. A. J. Henry upon "The Distribution of Maximum Floods," which appeared in the December, 1919, REVIEW and calling attention to the following points: (1) That true comparison of the magnitude of floods occurring in different years can be made only by comparison of the volume of flow, and (2) that at some of the Weather Bureau gages known to him the zero of the gages are not referred to a fixed plane of reference, and he gives two examples which will be referred to later.

The first point made by Mr. Leach is well taken, but since discharge measurements are not available, recourse was necessarily had to gage heights.

With reference to the second point: In establishing new gaging stations, the uniform practice of the Weather Bureau during the last 8 or 10 years has been to set the zero of the gages to correspond with the bottom of

<sup>1</sup> Author's abstract of paper presented before American Meteorological Society, Washington, D. C., Apr. 22, 1920.